

Series 5 Total Reach DDS-DP Total Reach All-Rate DDS Dataport Installation and Maintenance

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1. GENERAL

This practice provides installation and maintenance procedures for the ADTRAN Series 5 Total Reach[®] DDS-DP All-Rate DDS Dataport. **Figure 1** is an illustration of the ADTRAN Series 5 Total Reach DDS-DP (P/N 1433105L5).

Revision History

This is the initial release of this document. Future revisions will be described in this subsection.

Features

- 2-wire deployment
- Repeaterless operation
- Bridged tap tolerant
- Span power for remote Total Reach DDS-R termination unit
- Utilization in SLC Series 5 and Series 2000 channel banks

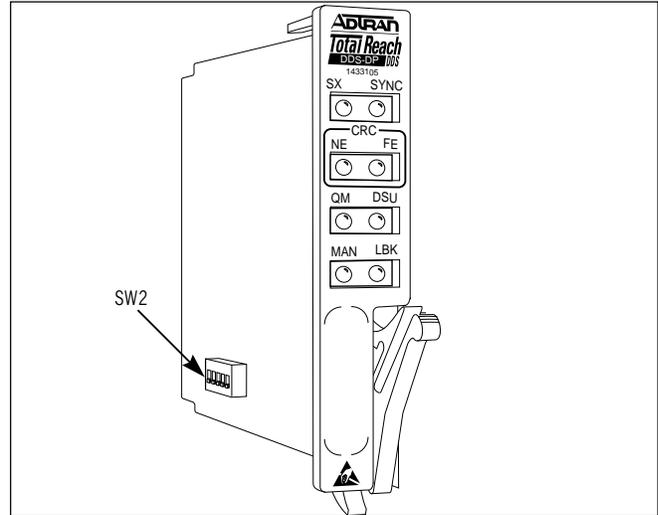


Figure 1. Series 5 Total Reach DDS-DP

- Loop Quality Monitor and A/B signaling options
- Bidirectional DS0 loopback capability
- Transmits Mux Out of Sync code upstream during out of service loop condition.
- Embedded Digital System 6 capabilities for remote provisioning, and performance monitoring.

Description

The ADTRAN Series 5 Total Reach DDS-DP is a functional replacement for the SLC[®] Series 5 OCU DP, CLEI 5SCU48, delivering data at rates up to 64 kbps using a single copper pair. Used in combination with the Total Reach DDS-R termination unit, the Series 5 Total Reach DDS-DP can accommodate extended loop lengths, eliminating the need for DDS repeaters. The Series 5 Total Reach DDS-DP span powers the Total Reach DDS-R located at the customer premises. The Total Reach DDS-R converts the 2-wire signal to the traditional 4-wire Alternate Mark Inversion (AMI) signal for presentation to the customer.

The ADTRAN Series 5 Total Reach DDS-DP occupies a single channel position in the AT&T[®] SLC Series 5 and Series 2000 or Series 5 compatible channel bank. It provides the interface between a DS0 timeslot of the T-carrier data stream and the 2-wire metallic loop extending to the customer premises. The

Series 5 Total Reach DDS-DP may interoperate over the carrier system with another Total Reach DDS-DP, OCU DP, DS0 DP, 1/0 DCS, or switch and may be located in an end office, hub office, intermediate office, or Digital Loop Carrier (**Figure 2**). The 2-wire loop is connected using the odd pair Tip (pin 31) and Ring (pin 32) on the Series 5 backplane.

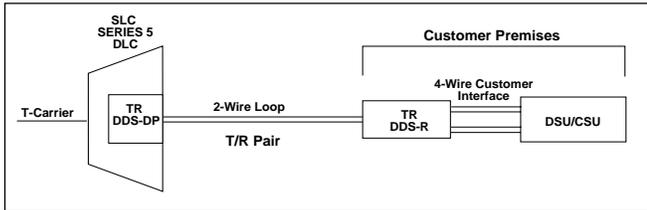


Figure 2. Total Reach DDS Circuit Diagram

NOTE

The Series 5 Total Reach DDS-DP must be used with an appropriate Total Reach DDS-R unit.

Options

The Series 5 Total Reach DDS-DP is provisioned through the SLC Series 5 system and an on-board DIP switch. SW2 provides feature options not available through the SLC Series 5 channel bank intelligent system. Use the SLC Series 5 Craft Interface Unit (CIU) to provision intelligent channel bank features supported by the Series 5 Total Reach DDS-DP. See **Figure 3** and **Table 1** for option description and provisioning.

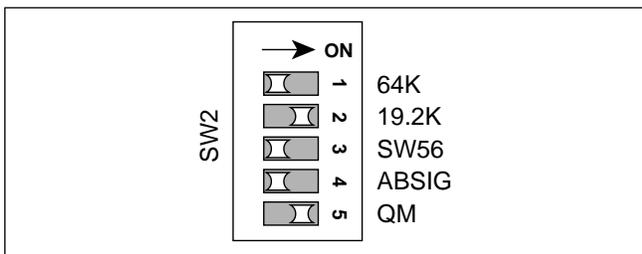


Figure 3. Option Switch

NOTE

Select OCU DP, CLEI 5SCU48, when provisioning via the CIU.

Error Correction

When error correction is enabled the Series 5 Total Reach DDS-DP provides an error detection and correction

Table 1. Option Settings

Software Provisioning via Series 5 BCU	
Function	Description
Rate	Select 2.4, 4.8, 9.6, or 56 kbps
Error Correction (EC)	If rate is 2.4 through 19.2, select: MVEC or NONE (SCEC not available at these rates on this card.) If rate is 56 through 64 kbps, select: SCEC or NONE (MVEC is N/A at these rates.)
Zero Code (ZC)	Yes or No
Secondary Channel (SC)	Yes or No
Hardware Provisioning via Dip Switch SW2	
64K	SW2-1 (64K) ON selects 64 kbps Clear Channel
19.2K ¹	SW2-2 (19.2K) ON selects 19.2 loop rate
Switched 56	SW2-3 (SW56) ON enables Switched 56 OFF disables Switched 56
A/B Signaling	SW2-4 (ABSIG) ON the unit determines the state of the A and B signaling bits using signals present on the channel bank backplane. OFF the unit derives signaling from the incoming data stream.
Quality Monitor	SW2-5 (QM) ON enables QM OFF disables QM
¹ For 19.2 kbps Error Correction select 19.2 on SW2 and enable 9.6 MVEC with SLC Series 5 CIU.	

capability that maintains data integrity across the carrier facility. For subrate and 19.2 kbps rates, error correction and data transmission is accomplished over a single DS0 time slot using a Majority Vote Error Correction (MVEC) algorithm. For error correction at these rates, MVEC must be selected in the BCU via the SLC Series 5 CIU.

For rates of 56 and 64 kbps, error correction requires one additional DS0 time slot for the error correcting parity byte. The Series 5 Total Reach DDS-DP only allows SCEC, the parity byte error correction scheme, at 56 and 64 kbps. When error correction is desired for 19.2 kbps service, provision 9.6 kbps and MVEC via the CIU and select 19.2 on SW2.

Zero Code

When Zero Code is enabled, the Series 5 Total Reach DDS-DP allows DS0 bytes of all zeros to enter the T-carrier data stream. On Alternate Mark Inversion (AMI) facilities, this function should be disabled. B8ZS carrier facilities that accommodate 64 kbps clear channel operation do not require the zero code to be suppressed, therefore zero code is automatically enabled when the 64 kbps rate has been selected.

Rate Selections

When 64K (SW2-1) is ON, the Series 5 Total Reach DDS-DP operates at 64K Clear Channel.

When 19.2K (SW2-2) is ON, the Series 5 Total Reach DDS-DP operates at 19.2 kbps.

When SW56 (SW2-3) is ON, the Series 5 Total Reach DDS-DP enables Switched-56 operation.

NOTE

Only one rate should be selected. Service rates of 64 kbps, 19.2 kbps, and Switched-56 are not supported by the SLC Series 5 BCU. These operating modes must be provisioned by enabling switches on SW2. A manual rate setting overrides BCU rate settings. The Series 5 Total Reach DDS-DP does not support 38.4 kbps.

The Total Reach DDS-DP can also be used in the SLC-2000 channel bank but the card must still be provisioned similar to the SLC-5 options. That is, 64 kbps operation the card is switch selected for 64 kbps while the assigned slot is selected for 56 kbps. For 19.2 kbps operation the card is switch selected for 19.2 kbps while the assigned slot is set for 9.6 kbps.

Signaling

When A/B SIGNALING (SW2-4) is OFF, the unit derives signaling from the incoming data stream. When A/B SIGNALING is ON, the unit determines the state of the A and B signaling bits using signals present on the backplane of the channel bank. This method assumes that proper signaling has been maintained throughout network tandems and cross-connect systems.

NOTE

A/B signaling option is only applicable when SW56 is selected; otherwise it is a “don’t care.”

Quality Monitor

When QM (SW2-5) is ON, the TR DDS-DP monitors the 2-wire loop and 4-wire customer interface for data errors. Excessive errors on the 2-wire loop cause the unit to send an alternating ASC (9Eh)/MOS (9Ah) to the network. Excessive errors on the 4-wire customer interface cause the unit to send an ASC to the network. In both cases customer transmission is blocked. When the trouble condition clears transmission is automatically restored.

2. INSTALLATION



After unpacking the unit, inspect it for damage. If damage is noted, file a claim with the carrier, then contact ADTRAN. See *Warranty and Customer Service*.

Tip/Ring Pair

The ADTRAN Series 5 Total Reach DDS-DP plugs directly into a SLC Series 5 channel bank. No special wiring is required. The 2-wire loop uses the T/R (Tip and Ring) of the odd pair, pins 31 and 32 of the SLC Series 5 backplane. The Total Reach DDS-R is not polarity sensitive, therefore the Series 5 Total Reach DDS-DP will operate even when the T/R pair is reversed.

Span Power

Span powering is accomplished using -130 Vdc measured from Tip to Ring. Voltage measured from Tip to GND should indicate -130 Vdc or less depending on input impedance of the measuring device. However, voltage measured from Tip to Ring should always indicate about -130 Vdc.

Synchronization and LED Indication

The Series 5 Total Reach DDS-DP and Total Reach DDS-R typically require 30 to 90 seconds to synchronize. When synchronized, the SYNC LOSS indicator LED will turn off. If synchronization cannot be achieved, check the T/R pair for open or short circuit conditions or load coils. Refer to **Table 2** for synchronization and operational status indication

3. TESTING

Testing for the Series 5 Total Reach DDS-DP is accomplished using the same test procedures for 4-wire

Table 2. LED Indication

Indicator	Description
SX	ON indicates no sealing current present on the local loop; check for continuity and proper DDS termination at remote end (TR DDS-R).
SYNC	ON indicates that there is no sync between the TR DDS-DP and the remote TR DDS-R; check for continuity, load coils, and other abnormal line conditions.
NE CRC	ON indicates that there are errors on the incoming data stream; check for the abnormal line conditions closer to the TR DDS-DP (NEAR END).
FE CRC	ON indicates that there are errors occurring towards the remote TR DDS-R; check for the abnormal line conditions closer to the TR DDS-R (FAR END).
QM	ON indicates that a Quality Monitor Disconnect has occurred.
DSU	Yellow indicates the absence of the customer DSU/CSU as determined by the TR DDS-R. Disconnected DSU/CSU, invalid framing pattern, or no RX signal from the DSU/CSU triggers a yellow LED. Green indicates presence of the customer DSU/CSU as determined by the TR DDS-R.
MAN	ON indicates rate has been manually selected using SW2.
LBK	ON if DSO loopback is active, OR if a DS6 session is active. FLASHING if OCU loopback active, OR if TR DDS-R has activated TR DDS-DP loopback toward customer.

DS0 DP units. The Total Reach DDS-DP only responds to latching DS0 DP loopback sequences.

NOTE

If 64 kbps is selected, the unit will only respond to latching loopback sequences. Alternating sequences are not valid at this rate.

Total Reach DDS-DP Bidirectional Loopback Support

The Series 5 Total Reach DDS-DP will execute a bidirectional loopback when performing a DS0 loopback, as shown in **Figure 4**. This allows a standard portable DDS test set, connected to the 4-wire customer interface of the Total Reach DDS-R, to verify the integrity of the 2-wire loop by transmitting a test pattern and examining the returning data for synchronization and errors. The Series 5 Total Reach DDS-DP LBK indicator will illuminate during this test mode.

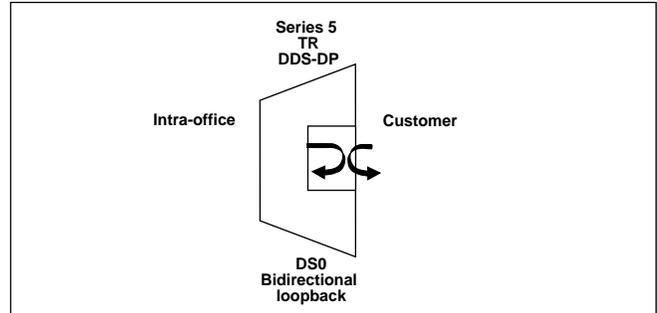


Figure 4. DS0 Bidirectional Loopback

The Series 5 Total Reach DDS-DP also responds to a loopback command sent by the Total Reach DDS-R when the LBK button on the Total Reach DDR-R is pressed. This allows loop testing to be performed from the remote end without test center coordination. The SLC Series 5 Total Reach DDS-DP only performs a loopback towards the customer in this case. The latching and alternating loopback sequences are defined in **Table 3** and **Table 4**.

Total Reach DDS Trouble Code

The Total Reach DDS system is designed to provide a quick diagnosis in the case of a circuit condition where continuity is broken. The trouble code type received by a tester determines whether the open condition is occurring on the local loop or at the customer premises. In the event of an open conductor or disconnected 2-wire loop, the Total Reach DDS-DP transmits an alternating ASC/MOS trouble code into the network as shown in **Figure 5**. In the event of a 4-wire open or disconnect, the TR DDS-R sends an ASC to the network as seen in Figure 5.

Remote End Initiated LBK Tests

The Total Reach DDS-DP supports loopbacks generated from the TROCU-R which allow testing to be performed without coordination with the CO or test center. Loopbacks initiated by the TROCU-R front panel LBK pushbutton aid in system turn-up testing or troubleshooting from the remote end.

Table 3. Latching Loopback Activation Sequence

Sequence Function	Byte Code	Number of Received Bytes
Clear existing loopbacks	Transition in progress (TIP) X0111010	Minimum of 35 TIP bytes
Identify device to be looped	Loopback select code (LSC) X0000101 - DS0 X1010101 - OCU X0110001 - CSU X1000001 - NIE	Minimum of 35 LSC bytes
Prepare to loop; send MAP code after 30 bytes	Loopback enabled (LBE) X1010110	Minimum of 100 LBE bytes
Activate loopback	Far-End voice (FEV) X1011010	Minimum of 32 FEV bytes
Minimum of 35 TIP bytes required to disable established latching loopback. X = Don't Care bit		

Table 4. Alternating Loopback Activation Sequence

Sequence Function	Received Bytes
Active loopback	Four consecutive bytes of specified loopback code X0101010 - OCU X0101000 - CSU X0101100 - DSU
Maintain loopback and test for bit errors	Data byte alternating with loopback code example: XDDDDDD1/X0101010
Clear loopback	Four consecutive data bytes without alternating loopback code
X = Don't care bit	

The TR DDS-DP will respond to a loopback command initiated at the TROCU-R as follows:

- Pressing the TROCU-R LBK pushbutton once will initiate a loopback at the TR DDS-DP towards the customer. See **Figure 6**.

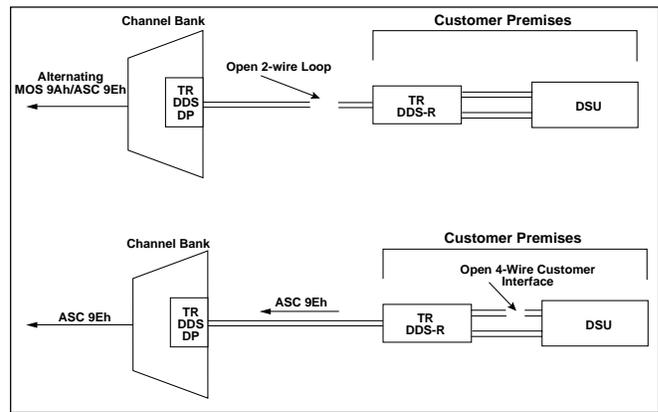


Figure 5. DDS Trouble Codes

This allows data to be sent from the remote end to test the local loop and the TROCU-R. This loopback is indicated by a flashing CUST LED on the TROCU-R and a solid CUST LED on the Total Reach DDS-DP.

- Pressing the LBK pushbutton a second time initiates a loopback at the TROCU-R towards the 4-wire DDS (CPE) interface. See **Figure 7**.

A solid CUST LBK LED on the TROCU-R indicates a loopback at the TROCU-R towards the customer equipment.

- Pressing the TROCU-R LBK pushbutton a third time disables all current latching loopbacks initiated by the TROCU-R LBK pushbutton.

If errors exist the loopbacks can help determine the source; either the local loop or the TROCU-R. During a remote end initiated loopback the Total Reach system transmits ASC 9Eh towards the network, indicating an out-of-service condition generated by the remote end as shown in Figures 6 and 7.

4. REMOTE PROVISIONING AND DIAGNOSTICS

Control Protocol

Remote access to provisioning and status information is accomplished using ADTRAN Digital System 6 Message protocol, defined in Control and Diagnostic Procedures Practice, Section 6032991-6. Digital System 6 is supported by the TPI 108/109 and 105 portable test set and is supported by Hekimian React 2001 Release 1.900 remote test system. The Total Reach DDS network elements comply with ANSI T1.107-1995, "Digital Hierarchy Format Specifications Annex G" which allows remote provisioning, querying, and performance monitoring via in-band control of network elements.

NOTE
The REACT 2001 GUI software Release 1.900 supports ANSI T1.107-1995.

Remote access is accomplished using a defined set of in-band DS0 byte sequences similar to the latching loopback sequence. Commands issued through the test system are recognized by the individual channel unit, which responds with the appropriate byte sequences. These in-band commands may be used to verify options via dialogs with REACT 2001 and TPI 108/109 test sets. Unit CLEI, serial number, provisioning, and performance information can be retrieved remotely using the Digital System 6 protocol.

NOTE
Due to SLC Series 5 channel bank BCU constraints, provisioning of the Series 5 Total Reach DDS-DP may be viewed but not changed via Digital System 6.

Out-of-Band Diagnostics

In addition to in-band access to Series 5 Total Reach DDS-DP performance diagnostics and provisioning via Digital System 6, access is also available out-of-band (non-intrusively) via the craft interface located

on the Total Reach DDS-R. The Total Reach DDS-R displays provisioning information, Total Reach system status, performance monitoring information stored in 15 minute and 24 hour registers for both the Series 5 Total Reach DDS-DP and Total Reach DDS-R and an event log which time stamps system performance anomalies and threshold violations. Physical access to the terminal interface on the Total Reach DDS-R is made by a serial interface connection to a dumb terminal or dumb terminal emulation. Provisioning of the Series 5 Total Reach DDS-DP may be viewed but not changed from the terminal interface on the Total Reach DDS-R. Further information about the Total Reach DDS-R terminal interface and performance monitoring may be found in the Total Reach DDS-R practice part number 61291023L2-5A

5. DEPLOYMENT GUIDELINES

The Series 5 Total Reach DDS-DP and Total Reach DDS-R use technology intended to eliminate the need for repeaters and concerns over impairments caused by typical noise and bridged tap. Listed below are the loop design guidelines for Total Reach DDS (see **Table 5** and **Table 6** for more information):

- All loops must be nonloaded.
- Actual Measured Loss (AML) should not exceed 50 dB at 13.3 kHz (135 Ω termination), the Nyquist frequency of Total Reach DDS.

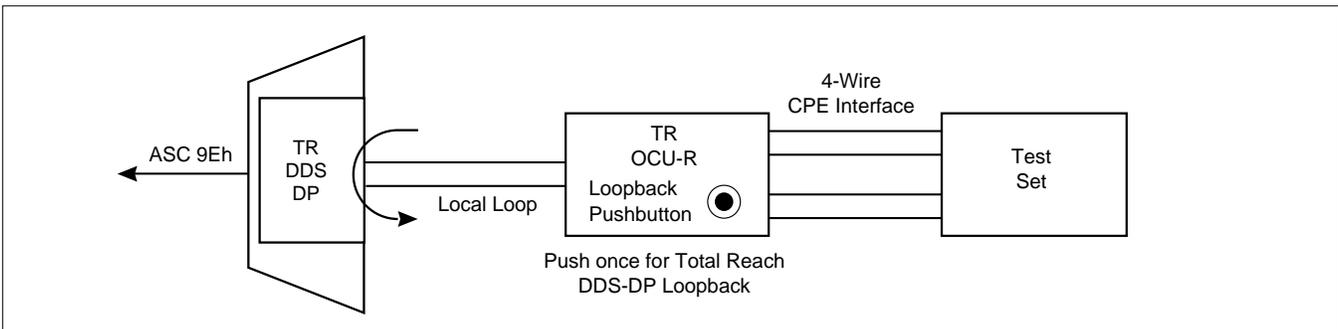


Figure 6. Total Reach OCU-R Remote End Initiated Loopback, Local Loop

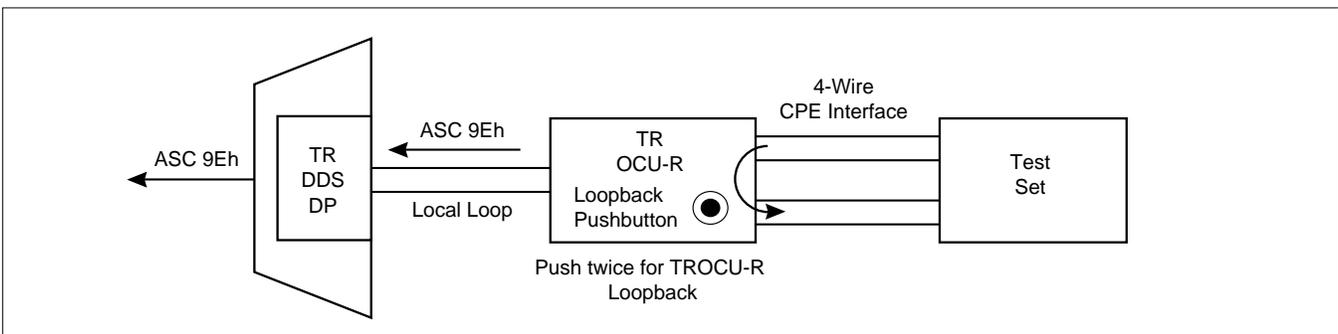


Figure 7. Total Reach OCU-R Remote End Initiated Loopback, Customer Loop

Table 5. Cable Type and Temperature Loss Data @ 13.3 kHz

PLASTIC CABLE	dB LOSS/kft	PAPER CABLE	dB LOSS/kft
19 Gauge PIC (0F)	0.5302	19 Gauge PULP (0F)	0.5616
19 Gauge PIC (70F)	0.6083	19 Gauge PULP (70F)	0.6415
19 Gauge PIC (120F)	0.6610	19 Gauge PULP (120F)	0.6955
22 Gauge PIC (0F)	0.912	22 Gauge PULP (0F)	0.9454
22 Gauge PIC (70F)	1.0258	22 Gauge PULP (70F)	1.0606
22 Gauge PIC (120F)	1.1015	22 Gauge PULP (120F)	1.1370
24 Gauge PIC (0F)	1.2571	24 Gauge PULP (0F)	1.2900
24 Gauge PIC (70F)	1.3982	24 Gauge PULP (70F)	1.4324
24 Gauge PIC (120F)	1.4917	24 Gauge PULP (120F)	1.5268
26 Gauge PIC (0F)	1.6751	26 Gauge PULP (0F)	1.6823
26 Gauge PIC (70F)	1.8469	26 Gauge PULP (70F)	1.8568
26 Gauge PIC (120F)	1.9608	26 Gauge PULP (120F)	1.9718

Table 6. Series 5 Total Reach DDS Insertion Loss Measurements

DDS 13.3 kHz compared to 28 kHz for traditional DDS service		
Line Configuration	@ 13.3 kHz	@ 28 kHz
27 kft 26 AWG	50.12 dB	65.35 dB
36.25 kft 24 AWG	50.00 dB	62.50 dB
50 kft 22 AWG	50.24 dB	59.33 dB

NOTE

The 50 dB AML limit includes 6 dB of signal margin to account for potential near-end cross talk (NEXT) from other digital services that may be provisioned in the same binder group.

- Loop length should not exceed 50 kft.
- Bridged tap length should not exceed 12 kft.
- Background noise level should not exceed 34 dBm.
- Impulse noise should not exceed -40 dBm, (+50 dBm).

NOTE

Measure noise with 50 kbit weighting characteristic approximating a filter with a passband of 40 Hz to 30 kHz. Background noise level or impulse noise level is referenced from 56/64 kbps data rate in TR62310.

6. MAINTENANCE

The Total Reach DDS-DP does not require routine maintenance for normal operation.

Compliance Requirements

CAUTION

This product for installation in a restricted access location in a Type B or E enclosure only.

Max input current @ max load = 165 mA @ -48 Vdc.
Max output current @ max load = 41 mA @ -140 Vdc.

Table 7. Compliance Codes

Code	Input	Output
PC	F	C
TC	-	X
IC	A	-

7. WARRANTY AND CUSTOMER SERVICE

ADTRAN will replace or repair this product within 10 years from the date of shipment if it does not meet its published specifications or fails while in service (see *ADTRAN Carrier Networks Equipment Warranty, Repair, and Return Policy and Procedure*, document 60000087-10A).

Contact Customer and Product Service (CAPS) prior to returning equipment to ADTRAN.

For service, CAPS requests, or further information, contact one of the following numbers:

ADTRAN Sales

Pricing and availability
(800) 827-0807

ADTRAN Technical Support

Presales Applications / Post-sale Technical Assistance
(800) 726-8663

Standard support hours:

Monday-Friday, 7 a.m. - 7 p.m. CST

Emergency support: 7 days/week, 24 hours/day

ADTRAN Repair/CAPS

Return for repair / upgrade
(256) 963-8722

Repair and Return Address:

ADTRAN, Inc.

CAPS

901 Explorer Boulevard

Huntsville, Alabama 35806-2807